ACTIVITY BUDGET AND SPACE UTILIZATION OF CAPTIVE BORNEAN ORANGUTAN

(*Pongo pygmaeus*)

By

Muhammad Zaki Zainol

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LIST OF SYMBOLS AND ABBREVIATIONS

IUCN	=	International Union for Conservation of Nature
OUIF	=	Orang Utan Island Foundation
BMOUI	=	Bukit Merah Orang Utan Island
TZ	=	Taiping Zoo
KZ	=	Kemaman Zoo
Km	=	Kilometer
ANOVA	=	Analysis of Variance
PCA	=	Principle Component Analysis
MVSP	=	Multi Variate Statistical Package

PERUNTUKAN AKTIVITI SERTA PENGGUNAAN RUANG ORANGUTAN BORNEO (*Pongo pygmaeus*) DALAM KURUNGAN

ABSTRAK

Haiwan endemik kepada Malaysia dan Indonesia, Orangutan Borneo (*P. pygmaeus*) telah diisytiharkan sebagai terancam kritikal pada tahun 2016 oleh sebab pemusnahan hutan secara berleluasa dan lain-lain tekanan yang diakibatkan oleh manusia. Orangutan yang diselamatkan dihantar ke pusat pemuliharaan dan bagi yang tidak dapat dilepas liar, ianya akan dihantar ke pusat-pusat kurungan contohnya zoo. Orangutan yang tidak dapat dilepas liar boleh dijadikan bahan pengajaran untuk pengajian hidupan liar. Oleh sebab itu, ianya amat penting untuk mengekalkan perilaku semulajadi orangutan dalam kurungan. Kurungan yang direka dengan baik termasuk kumpulan sosial yang sesuai dan penjagaan rapi haruslah disediakan supaya perkara ni terlaksana. Kajian ini dijalankan untuk menentukan peruntukan aktiviti dan penggunaan ruang orangutan dalam kurungan serta untuk mengkaji faktor-faktor motivasi terhadap pekerja kurungan. Untuk mendapatkan data perilaku dan penggunaan ruang, pengsampelan berfokus telah dijalankan selama 4,200 minit di tiga pusat kurungan di Semenanjung Malaysia yang dikenali sebagai Pulau Orang Utan Bukit Merah (BMOUI), Zoo Taiping dan Zoo Kemaman. Temuduga *in-depth* turut dilakukan di lokasi yang sama kepada 25 orang responden untuk menentukan faktor motivasi mereka. Peruntukan aktiviti orangutan di semua tempat telah didominasi oleh ‘berehat’ (60%). Perilaku agresif mencatatkan bacaan kosong dan lain-lain pergerakan seperti berjalan, memanjat dan bergayut adalah sangat rendah. Bentuk aktiviti tidak mencatatkan perbezaan yang signifikan antara lokasi. Namun demikian, kumpulan umur ada menunjukkan perbezaan terhadap bentuk aktiviti. Aras yang paling disukai adalah aras ‘0’; aras tanah (44%) dan diikuti dengan aras ‘3’-10m < x < 20 m (33%) manakala aras yang paling kurang disukai ialah aras ‘4’-x > 20 m dengan hanya 5%. Faktor motivasi tertinggi yang dicatatkan ialah ‘komoditi’ (37%) diikuti dengan ‘persekitaran’ (35%) dan ‘konservasi’ (22%). Faktor yang paling kurang ialah ‘pilihan sendiri’ dengan hanya 6%. Pemilihan ruang dalam kalangan orangutan mempengaruhi perilaku dan peruntukan aktiviti harian termasuklah perhubungan sosial mereka.

ACTIVITY BUDGET AND SPACE UTILIZATION OF CAPTIVE BORNEAN ORANGUTAN (*Pongo pygmaeus*)

ABSTRACT

Endemic to Malaysia and Indonesia, Bornean Orangutan (*P. pygmaeus*) was declared to be critically endangered in 2016 because of extensive deforestation and other human caused pressures. Rescued orangutans were sent to rehabilitation centers and those that unable to be release will be occupying captive centers i.e. zoo. The orangutans that unable to be released could be utilized as educational subject on wildlife learning. Hence, it is crucial to preserve orangutan natural behavior. Proper designed enclosure including suitable social group and intensive care must be provided to make this happen. This study was carried out to determine captive orangutan activity budget, space utilization and to study what are the captivity worker's motivational factors. To assess the behavioral and space utilization data, focal sampling was done for a total of 4,200 minutes at three captive centers in Malaysia namely Bukit Merah Orang Utan Island (BMOUI), Taiping Zoo and Kemaman Zoo. In-depth interview also carried out at the same locations for a total of 25 respondents to determine their motivational factors. Orangutan activity budget at all sites were found to be dominated by 'resting' (60%). Zero aggression behavior was recorded and other movement i.e. walking, climbing and hanging was minimal. The activity patterns have no significant different among sites. However, age group does showed differences on activity patterns. The most preferred level by the orangutans was level '0'; ground level (44%) and followed by level '3'-10 m < x < 20 m (33%) and the least preferred level was level '4'-x>20 m with only 5%. The highest motivational factor recorded was 'commodity' (37%) followed by 'environmental' (35%) and 'conservation' (22%). The least factor was "personal choice' for only 6%. Space preferences of orangutan did affect their behavior and daily activity budgets as well as social interaction.

CHAPTER 1

GENERAL INTRODUCTION

1.1.1 Background

Goossens et al., (2006) and Meijaard et al., (2010) mentioned that until recently, the population size and range of Bornean Orangutans reduced significantly due to human pressure and extreme climatic changes. In 2011, out of interview surveys in Kalimantan, Meijaard et al., found that sums of 2,000-3,000 orangutans were killed annually within the past four decades. This number is equivalent to a decrease of 44,160-66,570 orangutans (Davis et al., 2013) which is over 50% of the population in just 40 years' period. Marshall et al., (2009) said that this rate is unsustainable and it was predicted that this population reduction would continue and eventually come into extinction in 50 years' time (Abram et al., 2015). Except for Sabah, Bornean Orangutan's total population number is uncertain. In early 2000s, it was estimated that there were 11,000 individuals in the whole state of Sabah by using aerial survey (Ancrenaz et al., 2004).

Due to drastic decline of orangutan's population by uncontrolled human's interferences, rehabilitation centers were set up to conserve the orangutans. The objectives of orangutans (*P. pygmaeus* and *P. abelii*) rehabilitation centers in Malaysia and Indonesia are to provide required skills for orangutan's survival in the wild and to facilitate the release program (Descovich & Galdikas et al., 2011). It was revealed that habitat loss in Malaysia and Indonesia had caused rehabilitation centers to record vast number of orphaned orangutans (Russon, 2009). The cost on rehabilitation is high since it will involve rescue, reforestation and treatment on

injured orangutans. Moreover, not less than five years of time is needed to rehabilitate a young orangutan and completely mastered ecological skills so that they can be release into new habitat (Russon et al., 2007; van Noordwijk & van Schaik, 2005). These situations are concerning since the orangutans is endemic to Malaysia and Indonesia. By destructing the forest, we are raiding their habitats and more orangutans will be occupying rehabilitation center and other captive centers such as zoos and amusement parks from time to time. In this captive or semi-captive environment, orangutan's behavior would have been influenced by various factors which make it to be unnatural. Most disturbingly, under a wrong management practices and lack of proper care might directly affect their mental health and it will act as unneeded stressor.

1.2 Problem statement and objectives

Malaysia, specifically East Malaysia houses 10% of total world orangutan population. Some captivity centers either for conservation or merely on tourism purposes were established in Peninsular Malaysia. These centers could be a perfect location for the public to know their iconic species and learn on their behavior. However, the orangutan behavior in captivity was proven to be abnormal due to space allocation, habituation and food accessibility and this is not good for learning and educational purposes.

Hence, behavioral study on orangutan is crucial since orangutan usually behaves differently in wild compared to captivity and habitat quality also played an important role in affected some behavioral patterns (Bean, 1989 & Utami et al. 1997). Natural behavior must be able to be conserved although the orangutans are in captivity. Animal welfare act also strictly called upon all captivity centers to abide

certain rules and regulations regarding animal welfare in captivity which includes providing comfortable required spaces enclosure.

Due to the importance of orangutans to maintain as much normal behavior as possible in captivity, an assessment should be carried out to investigate their activity budget in captivity. Meanwhile, orangutan's canopy preferences also should be studied to achieve the same objective. Since the zoo workers are the closest to the captive orangutans and their work performances directly affected orangutan's well-being, it is important to study the factors that drive their work motivation and whether it is influenced by their academic level, economic background and experiences. A few objectives were pointed out and three captivity centers in Peninsular Malaysia were chose to fulfill those objectives. The objectives of this study are:

1.3.1 To compare the activity budget and behavior of captive orangutan at three sites by focal sampling and temporal analysis

1.3.2 To analyze the space utilization by focusing on height preferences of orangutans in their enclosures by focal sampling and spatial analysis

1.3.3 To study the motivational factor leading to job satisfaction of captivity workers on captive orangutan management by in-depth interview

CHAPTER 2

LITERATURE REVIEW

2.1 Bornean Orangutan

2.1.1 Taxonomy

Orangutans are large arboreal primate which endemic to Borneo and North Sumatra Indonesia rain forest (Rodman & Mitani 1987). In terms of appearances, the orangutans have dimorphism in size where the size of male orangutans is twice the size of female orangutans with males weighing on average forty-five to one hundred kilograms and female weighing about thirty five to fifty kilograms (MacKinnon, 1974). In the early years, Bornean and Sumatran orangutan were classified as subspecies under genus *Pongo* which were *P. p. pygmaeus* and *P. p. abelii*, respectively (Courtenay et al., 1988). Later on (figure 2.1), Bornean and Sumatran orangutans were proposed to be separate species of *P. abelii* and *P. pygmaeus*, with subspecies existing within the islands (Groves, 2001 and Brandon-Jones et al., 2004).

Domain **Eukaryota**

Kingdom **Animalia**

Phylum **Chordata**

Class **Mammalia**

Order **Primate**

Family **Hominidae**

Genus ***Pongo***

Species

***P. abelii* (Lesson, 1827)**

***P. pygmaeus* (Linnaeus, 1760)**

Subspecies

***P. p pygmaeus* (Linnaeus, 1760)**

***P. p wurmbii* (Tiedemann, 1808)**

***P. p morio* (Owen, 1837)**

Figure 2.1: Orangutan's taxonomy

2.1.2 Threat and Status

Population of Sumatran orangutan decreased drastically since the last century due to multiple causes which are deforestation, illegal trading hunting and poaching by human (Rijksenand Meijaard, 1999). Besides that, excessive illegal logging also led to landslides and flash floods that eventually caused disturbance on forest function and habitat fragmentation (Elliss et al. 2006). Orangutan requires large areas in their particular habitat. For this reason, orangutan is prone to extinction and has low population densities although they are in their suitable habitat (Rijksen and Meijaard, 1999). It was proved that in disrupted forest such as logged and secondary forest, the densities of Sumatran orangutan population are much lower (Rijksen, 1978; Payne, 1987; van Schaik et al., 1995). The status of Sumatran orangutan has long been in critically endangered and unfortunately in 2016, the Bornean orangutan also were declared to be critically endangered too (IUCN, 2016).

2.1.3 Behavior

2.1.3 (a) Wild

Unlike most other great apes, which lives in group of socially stable anthropoids, orangutans are primarily solitary. The interaction between orangutans with other animal or other orangutans does occur for only temporary period. When it comes to travelling, female orangutans were recorded to cover some small overlapping home range around 0.4-6 km^2. Meanwhile, male orangutan covers larger range of area which often includes multiple female orangutans within it. Solitary nature of female orangutans always paired with long period of lactation and gestation which naturally limits their sexual activity. This condition causes male to be competitive among their same sex classes for a few non-child bearing female in order

to breed. In terms of important features such as grouping and mating behavior, orangutans are differing from other anthropoid primates. (Rodman & Mitani, 1987). In the wild, feeding behavior and population density are often influenced by habitat quality especially in term of space used (Bean 1999; Utami et al., 1997). As a naturally solitary animal, orangutan will keep their distance from each other in the wild especially during non-fruiting season due to low food availability. But they may be found feeding in a group on the peak fruiting season (Russon 1999; Sugardjito et al., 1987).

2.1.3 (b) Captive

Spring et al., (1997) said social interaction is a better way to reduce abnormalities of captive animal behavior compared to objects enrichment. He also found that singly-housed monkeys expressed abnormal behavior more frequently and relatively more passive compared to group-housed monkeys. Same result was obtained where group-housed rhesus monkeys recorded less time exhibiting abnormal behavior than singly-housed rhesus monkeys (Schapiro et al., 1996).

The management of husbandry and captive environment had significant influence on the behavior of wild animals and successfulness of captive breeding programs (Carlstead, 1996; Hosey, 2005; Morgan & Tromborg, 2007). Akers & Schildkraut (1985) and Lukas (1999), in their finding stated that gorillas were observed to perform rare and abnormal behavior while in captivity. Those unusual behaviors such as vomiting and re-ingesting are believed to be due to extreme zoo environment.

Observing zoo primates allow much new information such as subtle behavior which often to be missed in wild to be spotted. Long term study of Japanese

macaques at Rome Zoo (D'Amato et al., 1982; Scucchi et al., 1988; Schino et al., 1993) and chimpanzees at Arnhem (de Waal, 1978,1982, 1984; de Waal and Van Hooff, 1981; Preuschoft et al., 2002) had been very helpful in improving knowledge on group dynamic, alliances, coalition formation in primates and post-conflict behavior. In different case study, unusual behavior such as tool use was shown by orangutans (O'Malley and McGrew, 2000), bonobos (Gold, 2002) and gorillas (Nakamichi, 1998); fruit smearing by chimpanzees (Fernandez-Carriba and Loeches, 2001); predation by woolly monkeys (Stearns et al., 1988) and lemurs (Jolly and Oliver, 1985; Glander et al., 1985) were the best representative of most bizarre behavior seen in the wild. These findings prove there are significant advantages in doing behavioral study in zoo despite the mainstream myth that a priceless behavioral research is impossible in zoos because it is just a fabricated environment.

Multiple regression method was applied by Perkins (1992) to identify vital variables affecting orangutan's behavior. She found that plenty of mobile objects and increase in social exposure within ample captivity significantly improved activity frequency in the orangutans. Naturalistic environment can provide complexity of space and structural to be similar with wild habitat. This attempt will result in normal-wild spatial use by orangutans within enclosure. A clear example was shown by Hebert and Bard (2000) in their study where the orangutans were recorded to spent majority of their time resting in the upper canopy and subsequently avoiding the floor right after high trees and vines were installed and the enclosure's floor was flooded.

Other factor causing change in behavior on captive primate is feeding method. Normally in the wild primates use to roam around to find food. In the other hand, they were fed by captivity worker in enclosure. This change was adapted by captive

primates and later cause in decrease of foraging and feeding activity (e.g. Britt, 1998). In reverting them back into naturalistic behavior, the way of food being presented could be change, for example, supply chances for the animals to get in the wild (McGrew et al., 1986), dispersing food in the substrate (Anderson and Chamove, 1984) and, providing whole rather than chopped fruit (Smith et al., 1989).

2.1.4 Activity Budget

Primarily, the activity budgets of an animal are affected by reproductive, nutritional, anatomical and social factors. (Rodman & Mitani 1987). Inter-individual variations in activity budgets did not exist among orangutans of same age-sex class (Mitani, 1985). Case study on female captive Wied's marmosets (*Callithrix kuhlii*) found lower cortisol levels in an established pair than in a new pair (Schaffner & Smith, 2005). Aureli and Yates (2010) suggested that allogrooming led to tolerance increase and distress prevention of crested black macaques (*Macaca nigra*) as they expressed active social behavior and less anxiety right after allogrooming activity.

Level of activity related positively with group size in captive orangutan which proved social stimulation to be beneficial to this naturally solitary species. Socially-grouped orangutan expressed active behaviors such as allogrooming and social play than solitary-captive individuals (Perkins 1992). Orangutan spent small amount of time on courtship, tool utilization, building nest of social engagement (Descovich & Galdikas et al., 2011). Most of important gesture of orangutan such as hanging, standing and sitting was displayed during nest building (Sugardjito and van Hooff 1986). Activity budget of particular primate species must be studied accordingly since different species might exhibit different result as proved in a case

study of captive Sulawesi *Macaca nigra* which recorded their activity budget shows no significant different from the wild while having different activity budget between zoos (Melfi and Feistner, 2002).

2.2 Captivity Management

Carlstead and Shepherdson (1994) and Ruiz-Miranda et al. (1998) said that, well-being of an animal is directly related to successful captive breeding program. A naturally solitary animal can be successfully grouped in captivity as long as basic resources such as food and space are sufficient. This situation creates flexibility for the naturally solitary animal to engage in a well maintained group sizes in enclosures (Price & Stoinski, 2007; Swaisgood & Schulte, 2010).

Orangutans (*Pongo pygmaeus* and *Pongo abelii*) are great example of successfully grouped solitary animal in zoo although never live socially in the wild. This condition occurred due to their adaptation on benefits they gained from this practice (Perkins, 1992; Price & Stoinski, 2007). Powell and Svoke (2008) and Watters and Powell (2012) said that individual differences effects in captive animal behavior can be easily described by an established captivity worker and there is high potential for zoo management to adopt personality assessments for captive animal well-being improvement.

In the zoo, animals are not able to roam freely as normal. This fact creates negative perception of majority of people to the zoo environment due to restricted space allocation to the captive animals (Rhoads & Goldsworthy, 1979; Finlay et al., 1988). However, people must be well informed and educated that not all primates, regardless captive of non-captive could afford to live in unrestricted space. This is proven by a 40 years study on ring-tailed lemurs *Lemur catta* at the Berenty Reserve

in Southern Madagascar. The particular studied troops have remained at the same home ranges along the period of time (Jolly & Pride, 1999; Mertl-Milhollen, 2000). Meanwhile in different species, distinct ranging patterns in the wild will definitely affect their responses to minimum space provided in the enclosure (Clubb & Mason, 2003).

The objectives of orangutans (*P. pygmaeus* and *P. abelii*) rehabilitation centers in Malaysia and Indonesia are to build required skills for their survival in the wild and to facilitate the release program (Descovich & Galdikas et al., 2011). Russon (2009) found that rehabilitation centers recorded an increment on the number of orphaned orangutan due to exponential habitat loss throughout Malaysia and Indonesia. To rehabilitate a young orangutan so that they can be release into new habitat is time consuming because they need more than five years to completely mastered ecological skills (Russon et al. 2007; van Noordwijk and van Schaik 2005).

2.2.2 Animal Welfare

To abide animal welfare rules, general guidelines and space requirements had been provided for a proper housing of non-human primates in captivity according to *The Guide for Care and Use of Laboratory Animals* and the Animal Welfare Act-1991 revised edition. Welfare of socially grouped animals can improve positively due to high chances for them to express wild behavior among them (De Rouck et al., 2005). The benefits of this practice include promoting reproductive success (Mellen, 1991; Carldstead & Shepherdson, 1994; Kleiman, 1994; Wielebnowski, 1998) and Caro (1993), also mentioned it will efficiently educate zoo visitors about animal natural behavior in the wild.

Meanwhile, individual animal responses differently to environmental elements (Carldstead & Mellen et al., 1999; Jones & Gosling, 2005; Kuhar et al., 2006; Hill & Broom, 2009) and individual differences are vital for the assessment of animal welfare (Hill & Broom, 2009). Study on captive animal behavior and its influences on captivity breeding, management and welfare has been done extensively since the last fifteen years (Powell & Svoke, 2008). In improving conservation and animal lives in captivity, properly designed, naturalistic (Coe, 1985) as well as convenient environmental enrichment must be provided.

2.2.3 Space and Canopy Utilization

In pristine habitat, orangutans are highly arboreal animal and spend most of the time travelling within canopy to avoid predators (Sugardjito & Van Hooff, 1986; Thorpe & Crompton, 2006). Meanwhile, in separate study by Galdikas (1978), it is shown that for long trip, instead of using higher canopy adult males prefer to travel on ground. It is common to observe abnormal behavior such as occupying lower canopy or ground level in captive orangutan rather than wild orangutan and it is believed that their weight plays crucial role for this unlikely behavior (Bean 1999; Sugardjito et al., 1995).

To ensure psychological sustainability of captive primates, detailed housing guidelines could be established by revealing the environmental preferences in studying their pattern of space utilization (Coe, 1985). Maple and Hoff, (1982) and Reinhardt (1992) pointed out that sufficiently spacious enclosures, suitable enrichments and social group contact are vital needs of non-human primate in captivity. James-Aldridge and Gorena (1991), Maple (1982), Traylor-Holzer and Fritz (1985) as well as Menzel (1969) had documented space utilization patterns on adult chimpanzee.

Captivity condition variable, social group composition, individual rearing background, age and sex are the factors that influence space utilization on chimpanzee (Traylor-Holzer & Fritz, 1985; Maple & Stine, 1982; Menzel, 1969). Meanwhile, current research shows that chimpanzees require improvement on their enclosures enrichment as the vertical space increased (James-Aldridge & Gorena, 1991; Matevia et al., 1991; Mallinson, 1982; Maple and Stine, 1982). Estevez and Christman (2006) mentioned that captivity environment caused limitation on animal behavior thus deep understanding on animal's space utilization and environmental characteristic could produce animal-friendly captive environment that suits their biological needs and ensuring the inhabitant's welfare.

Animal psychological and health states including needs and preferences could be extracted by measuring their behavior and space utilization patterns within enclosures (Mench & Mason, 1997). Mallapur et al., (2002), O'Neill et al., (1991) and Wielebnowski et al., (2002) conclude that enclosures which spaced accordingly and well enriched is highly beneficial to some of animal species. Meanwhile, poor environmental features of artificial captivity will cause discomfort and induce stress which may lead to psychological, behavioral and welfare condition (Wurbel, 2001; Morgan & Tromborg, 2007). Ogden et al., (1990) and Stoinski et al., (2001) found high preferences of gorillas and chimpanzees on perimeter walls of their respective enclosures. Significant effect on captive gorilla's space utilization was also recorded on the use of key elements of the environment such as trees and rocks (Ogden et al., 1990).

Meanwhile, in island habitat, adult female chimpanzees distinctly used their particular spaces which led to a decrease in close social contact among them (Bettinger et al., 1994). Based on a study, doorways, corners, mesh walls, and

elevated areas were highly preferred by gorillas and chimpanzees in an un-naturalistic artificial environment and they also avoiding open spaces within the enclosures (Ross & Lukas, 2006). Viewing platform or area such as glass partition to the public may act as stressors to captive non-human primates (Goerke et al., 1987). The interconnection between animal welfare and captivity design could be assessing by comparing the animal biological and behavioral requirements and suitability of enclosure environment (O'Neill et al., 1991).

2.3 Motivational Factor

Turner et al., (2004) and Faul (2008) stated that as the cities grow larger, the nature degradation and habitat destruction continues. 12 million people migrated from rural area into urban site per year in China resulting in worrying fact that its urban population is estimated to be over one billion in 2050 (Chen, 2000). By relating nature conservation with cultural, recreational, health, educational and spiritual importance the effort has increasingly appeared more significant in urban area (Wolf 2005; Davison & Ridder 2006). Urban biodiversity conservation is impossible without local resident's subtle motivation in the form of attitudes and understanding of current issues (Walpole & Goodwin 2001). Meanwhile, local authorities recognized conserving biological diversity in urban habitation as a key environmental challenge (Murphy, 1988). This challenge is then tackled by local people involvement since it is essential to highlight nature's issues and its value to residents (Miller & Hobbs, 2002). This is due to the fact of effective nature conservation strategies is often driven by people and controlled socially (Rudzitis & Johansen 1991; Evans 2004).

Motivational factors that lead to environmental conservation volunteerism are divided into motivational tools and motives. Tools of motivation includes economic compensation, incentives and bonuses while effectiveness of work performance is driven by various motives for example commission earned, challenge to hit sales target and even to please the employer. By engaging environmental volunteer works, people often develop good feeling about themselves as they believe it can positively affect the world by doing so (Mirowsky & Ross, 1989). Besides that, social networking improvement also has been linked to environmental volunteering activities (Gooch, 2005).

The level of worker's effort will degenerate upon realizing they are underpaid (Adams, 1965) however, Lazear (1991) suggested that salary inequality may not directly affect the loss motivation or productivity since it may be replaced by other factor such as work place harmony. As derived from anthropology and emphasized by Akerlof (1982), loss of motivation and productivity could be avoided by providing reciprocity and gift exchange by giving something such as gift, enough compensation, allowance, benefits or even required knowledge which will lead to mutual gain in an organization. As a result, employees will feel enough paid and may happily put more effort in their work.

2.4 Recent Primate Studies in Malaysia

Many primate researches had been done in Malaysia currently which covered various aspects such as medical and veterinary, activity budget and behavior, genetic, human-macaque conflict, food preferences and even archaeology. A study on human evolution and *Pongo* fossil by Ibrahim, Y. K. et al., (2013) concludes that environmental condition of the peninsular during the Last Glacial Maximum caused

local extinction to *Pongo* sp. due to inhabitability. They also found that *Pongo* sp. remain absence in Peninsular Malaysia to date due to a renewed sea barrier make the re-colonization from Sumatran rainforest impossible. Meanwhile, in the field of medical, veterinary and intensive care orangutan also was covered in a study by Dharmalingam, S. (2016) where it was pointed out that Upper Respiratory Tract Infections (URTI) is common in infant orangutan between ages one month to two years and it is vital to monitor the signs and treatments during the recovery period since URTI may lead to lower respiratory tract infection.

Besides that, a research on activity budget carried out at Kuala Selangor Nature Park to study long-tailed macaques (*Macaca fascicularis*) by Hambali, K. et al., (2012) found that more than 80% of the *M. fascicularis* times were budgeted for active activities such as moving, feeding, grooming and mating. The study also pointed out that *M. fascicularis* did interact with silvered-leaf monkeys group in fighting and grabbing food. Apart from obnoxious disruption of *M. fascicularis* on the visitors, a rare behavior of mating between long-tailed macaques and a cat found in that area was also recorded. In terms of diversity and species abundance, Ruppert, N. et al., (2015) found that species abundance was greatly influenced by joining oil palm plantation areas and distance to the forest edge and highlighted the importance of studying the ecology of small mammals for conservational problems since they belongs to the less studied species in local rainforest.

Meanwhile a study on genetic also was carried out to examine the monophyly of *Presbytis* and it was confirmed that *Presbytis* is monophyletic and share no similar ancestor to *Trachypithecus* (Zain, B.M.M. et al., 2008). Apart from that, Zain B.M.M. et al., (2014) also used genetic sequencing approach based on cytochrome *b* to study the phylogenetic correlation of Malaysian *Macaca fascicularis* in another

research. Human conflict study by questionnaires was also done at overlapping niches between human and macaques and indicated that less than 10% prefer the presence of macaques meanwhile high number of respondents were afraid of macaques and 15% of them will feel better if the macaques got eradicated (Zain B.M.M. et al., 2014). This study was also supported by another study by Hambali, K. et al., (2014) which showed that almost 30% of *Macaca fascicularis*'s diet comprise of human sources food as compared to natural sources. They pointed out that this situation might be the main reason that caused human-macaque conflict to occur.

CHAPTER 3

MATERIALS AND METHOD

3.1 Study sites and location

This study took place at three different orangutan captivity sites in peninsular Malaysia which are Bukit Merah Orang Utan Island **(**BMOUI), Perak [5° 0' 32.4936" N, 100° 40' 34.32" E], Taiping Zoo, Perak [4° 51' 17.802" N, 100° 45' 5.022" E] and Kemaman Zoo, Terengganu [4° 17' 54.4956" N, 103° 23' 8.07" E] (figure 3.1). These centers were chosen after a preliminary study found that all these sites possessed sufficient number of orangutan for the study. Three types of data were obtained from each study site which are activity budget behavioral data by focal sampling, orangutans canopy utilization data by focal sampling and in depth interview data on worker's motivational factor.

3.1.1 Bukit Merah Orang Utan Island (BMOUI)

BMOUI was established in the year 2,000 at Bukit Merah Lake within small town of Semanggol in Perak. This 14 ha island is under the management of Orang Utan Island Foundation (OUIF) Bukit Merah and had become a tourism spot to large number of crowd since their opening due to their strategic location (within Bukit Merah Lake Town Resort). Located at southern side of Bukit Merah Lake, OUIF managed two separated islands known as BMOUI and BJ Island (originally known as Panjang Island). BJ Island was named after the current dominant male orangutan on BMOUI (BJ King) and was opened to allocate the orangutans under their rehabilitation process. To access BMOUI, passenger's ferries were used from Bukit

Merah Lake Town Resort's jetty and it took approximately 15 minutes to reach BMOUI (figure 3.6). However, BJ Island was accessible only by using small boat since it was not open to the public.

The orangutan's enclosure in BMOUI is unique since they were designed into a 200 meters tunnel of trail surrounded by orangutan's enclosures. The orangutans were grouped by age as shown in figure 3.1.4. Visitors were escorted into the trail by a Public Relation Officer and researchers were able to observe the orangutans from the observing platforms provided. Specifically for the inhabitant of BJ Island, the orangutans were allowed to roam freely throughout the entire island and no observation platforms were provided and strictly not accessible to the public.

3.1.2 Taiping Zoo

Meanwhile, Taiping Zoo is located about 20 km to the south from BMOUI within the district of Bukit Larut Taiping, Perak. It is also one of popular tourism spot among Malaysian and foreigners. Covered about 14 ha of land, this zoo exhibited 1,300 animal comprising 180 species of amphibian, mammals and reptiles. Among all these animals, there are four resident female orangutans and one male orangutan which were recently translocated from Singapore Zoo for breeding purpose.

Orangutans at this place were exhibited at a spacious enclosure bordered by thick concrete wall and a wide drain that prevented them from crossing out of the enclosure. Approximately 15 meters of artificial climbing structures were installed inside this enclosure. The enclosure is connected directly to the orangutan's sleeping cages to ease their movement.

3.1.3 Kemaman Zoo

Officially open in 2009, Kemaman Zoo is the first zoo ever to be opened in Terengganu state of Malaysia. Located in 54 ha space area of Kampung Ibok, this zoo is approximately 14 km distance from the town of Chukai in Kemaman District, Terengganu. Housed four individual orangutans, it is a famous retreat destination for Kemaman local people and is the largest natural habitat for fireflies in Terengganu.

The orangutans were exhibited on a special man-made island equipped with artificial platform structures standing more than 10 meters above the ground. A long observatory bridge was built around the island for the visitor. During this study period, only two orangutans were exhibited on the island and the other two were exhibited in individual cages next to the exhibition island.

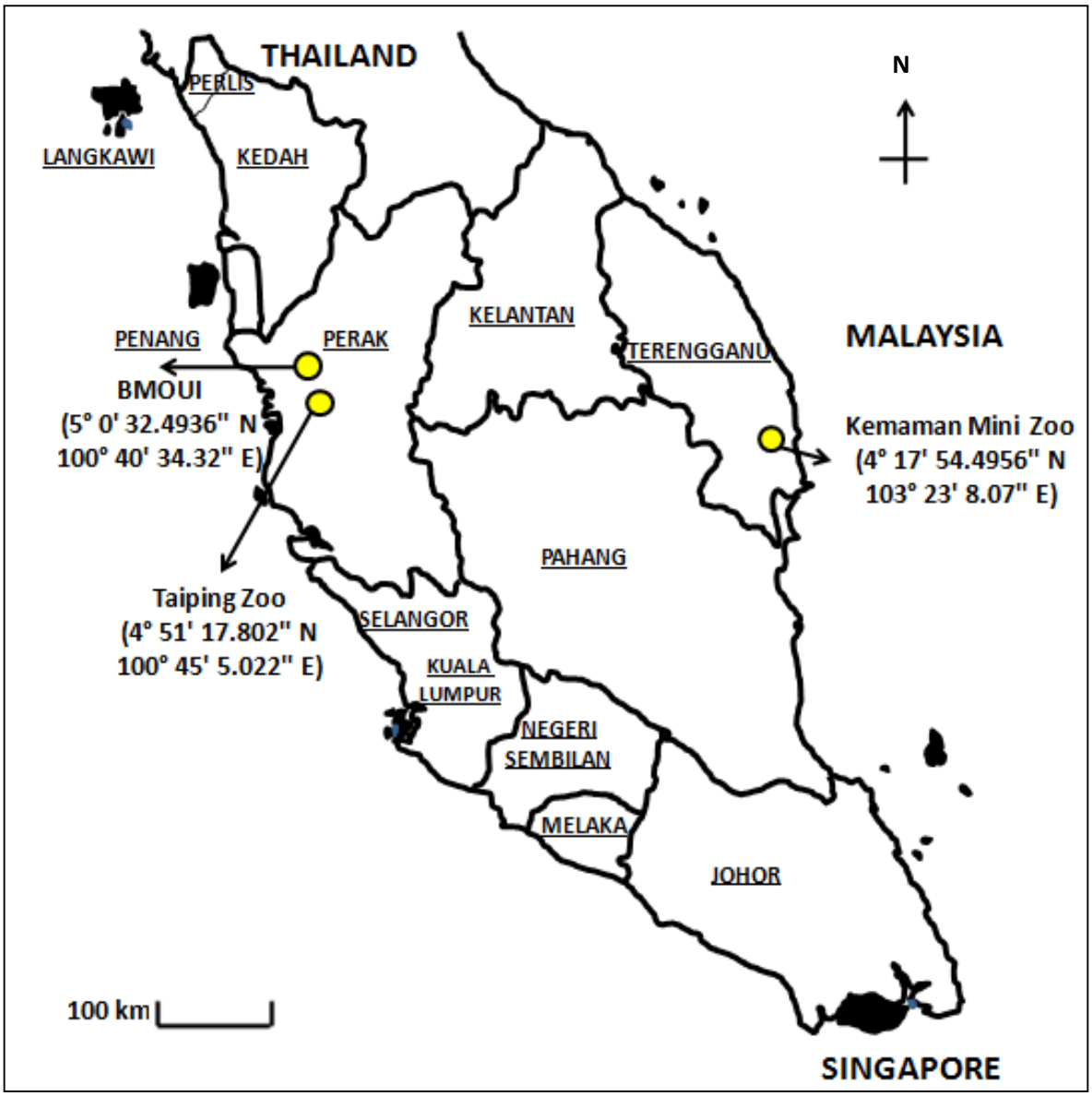

Figure 3.1: Location of BMOUI, TZ and KZ in peninsular Malaysia.

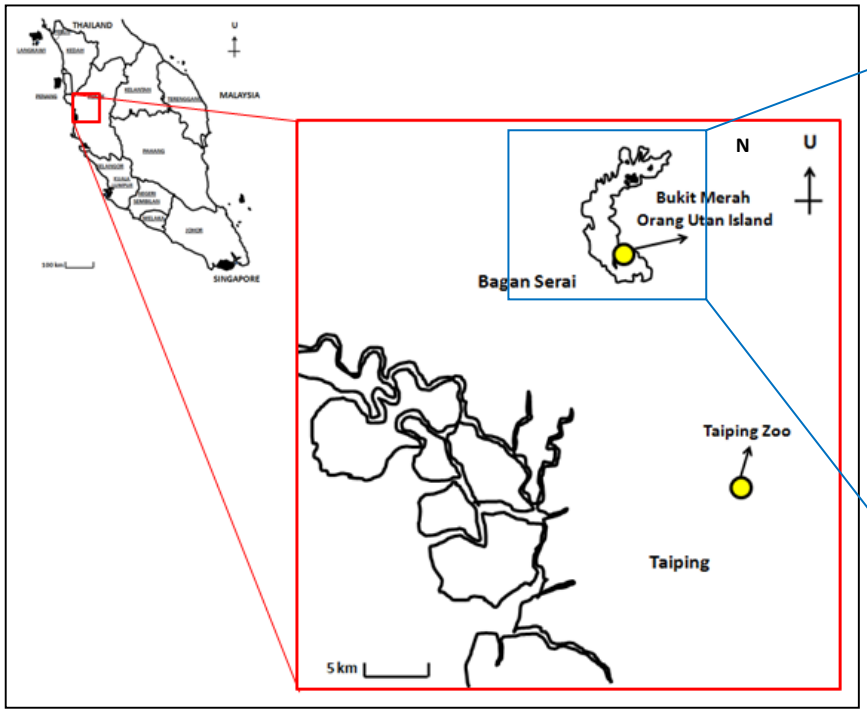

Figure 3.2: Location of BMOUI and Taiping Zoo in Perak State, Malaysia.

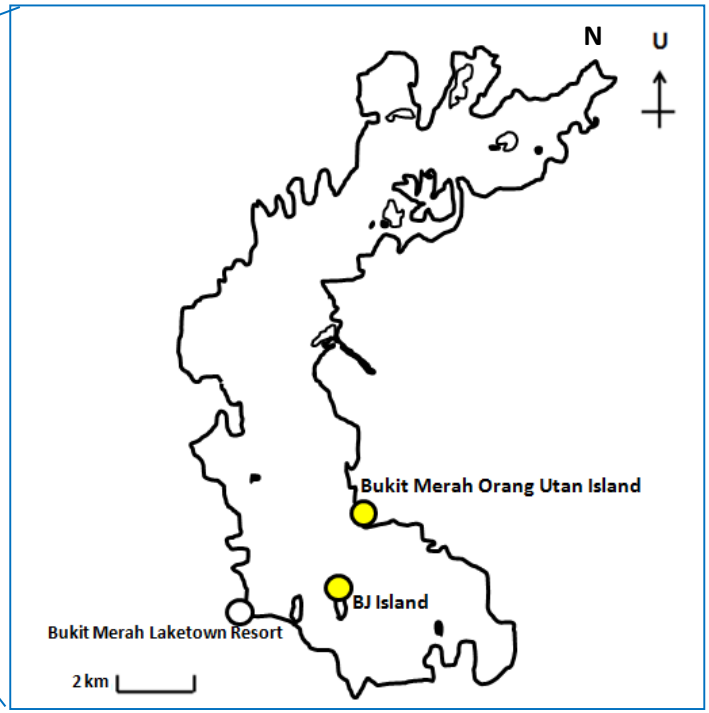

Figure 3.3: Specific location of BMOUI and BJ Island in Bukit Merah Lake.

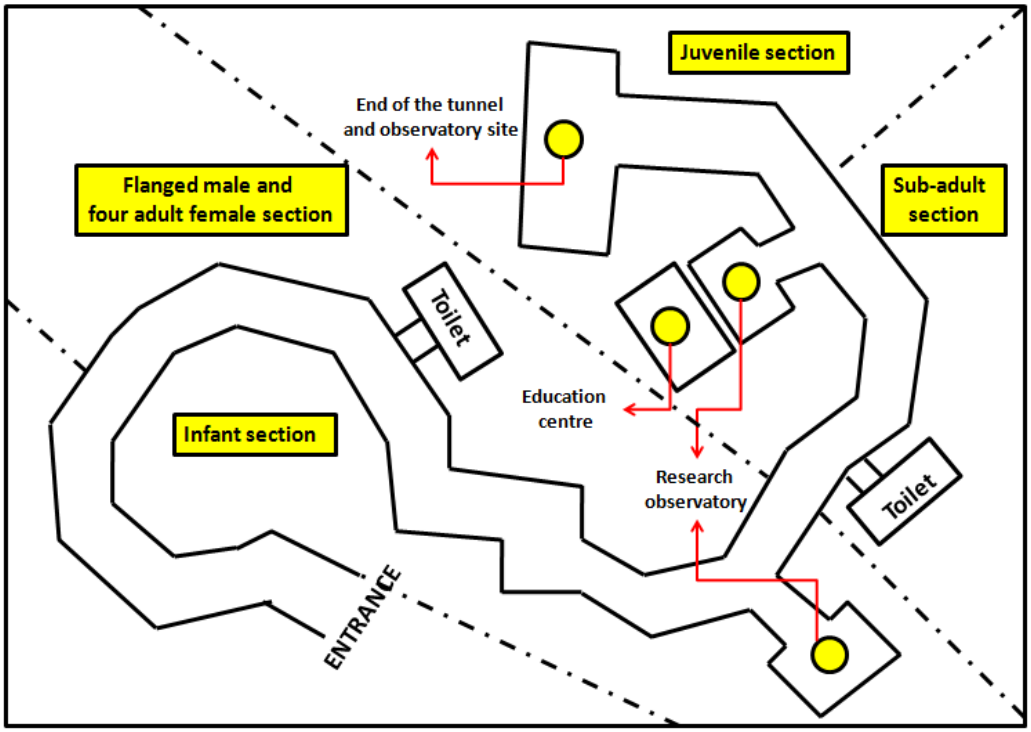

Figure 3.4: Layout of observatory trail at BMOUI; layout credit to Salniza Akmar & Aini Hasanah

Figure 3.5: BMOUI entrance at Bukit Merah Laketown Resort

Figure 3.6: Ferry service at BMOUI

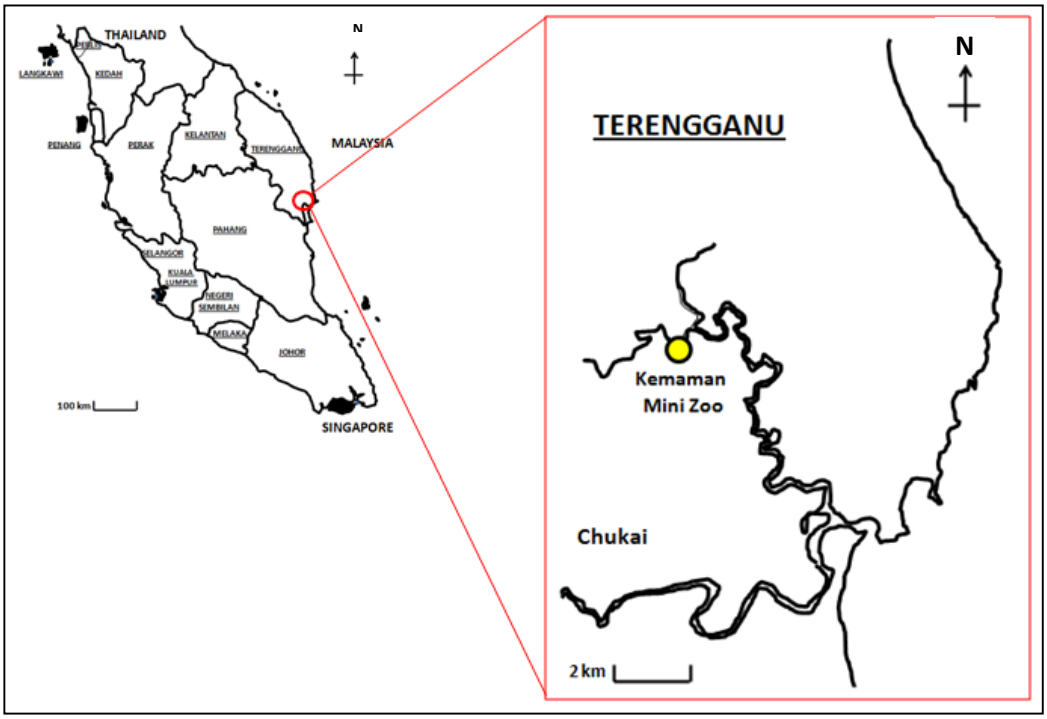

Figure 3.7: Location of Kemaman Mini Zoo in Chukai Kemaman, Terengganu.